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I have pursued them, have no experimental virulence whatever in any of the usual small animals. The large bacillus (already spoken of) which causes embolic hemorrhage in the kidney in some cases of Swine-Plague, also causes broncho-pneumonia in diseased swine, but is harmless otherwise. The specific disease supplies the field, or opens the way, for the action of these adventitious germs through the disturbances of the circulation. That similar lesions may be due to microorganisms which also find their way into the circulation from the intestinal tract I have no doubt, though I am utterly without experience in that direction.

As a termination to this part of my story I will again repeat: It is absolutely necessary to determine whether these deutero-micro-organisms are simply invasively-mechanical in their action, or which of them also cause secondary infection.

THE SILVER LAKE OF OREGON AND ITS REGION.

BY E. D. COPE.

IT took me three days and a quarter to ride to Silver Lake from Fort Klamath, by an indirect road. We came by Sprague river and Siacan Valley. The former runs into Williamson's River and into Lake Klamath.

Before I left Fort Klamath, the soldiers brought in a splendid lot of trout from these rivers, and I secured several in alcohol. They were the *Salmo purpuratus* Pallas, and I have described their numerous variations in the Philadelphia Academy Proceedings for 1882. The largest weighed twelve pounds.

Next day I started out with a four mule team and wagon with provisions. I rode a cavalry horse, "Jim," a heavily-built gray, with a good outfit of saddle-bags and straps. They gave me an old Klamath chief as a guide, from the Agency near by. This was

old Chaloquin, who was a great fighter in his day. He was a little man, with fat face, prominent eyebrows, retreating forehead and long hair. He was very good natured, smiling broadly on all interesting occasions, and appears to be of a kindly disposition. He was pleased to find that I knew the Klamath names of some fishes, such as Tswam, Xoöptu, Yehne (large suckers) Metash (trout), etc. He taught me the names of various wild beasts, as Mitap (bear), Yoho (elk), Lok (puma), and various other words. But he couldn't talk English, and I got very little information from him, and he could not understand me. So on the second day out I found a wild young Modoc, Pete by name, who could speak English pretty well, and I hired him instead. I paid the old man off after a friendly palaver, and furnished him with mucky-mucky (provisions) for the return trip.

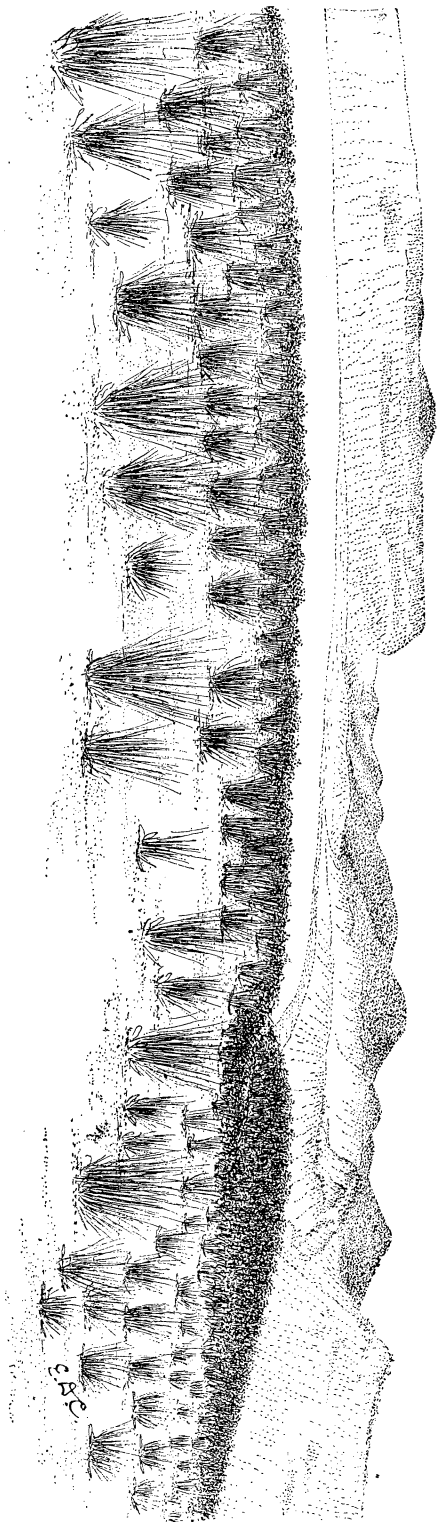
I found the Corporal Cronk, who had charge of the army property (animals, horses, wagons, etc.) which carried me and my provisions, to be a very inconvenient man. He was very much afraid that some trouble would befall the property, so he bothered me very much. He lost much time by making camp too early in the afternoon of the first day, and I gave him a talking to about it. So the next day he did better, and made a longer ride. I had plenty of time at the first camp, which was on the edge of a grassy meadow, by a splendid stream, clear as glass, which rose from the ground close by. So I went fishing with a mosquito-bar net I got from Mrs. Colonel Whipple, of Fort Klamath, with old Chaloquin holding the other end. We caught small fishes of five or six species, till it was quite dark. Next day we passed a few houses near the Sprague river, forming a place called Yainax. Then, after going eight miles, we forded the river and turned north, and made a camp four miles further, in a little open valley in the woods. The whole country is hilly and mountainous, and covered with tall woods of *Pinus ponderosa*, except the valleys, which are full of good coarse grass. Old Chaloquin carried his bag of wokus for food. This is the roasted and ground seeds of the yellow water-lily, and looks something like cracked wheat. They carry a cup, and mix the wokus in it with water. It swells up

and makes a very agreeable mush, with a taste between farina and coffee.

Modoc Pete started with us on the third day. I was determined to get to Silver Lake on that day, and so I put a can of tomatoes, some hard-tack and some bacon in my saddle-bags to guard against accidents. I left the wagon behind, and rode off through the woods with wild Pete. We soon came across two mule deer, and later three antelope crossed the road before us. Pete called them with a peculiar cry, and they soon turned round and came toward us. Had we had a gun we could have shot one or two of them. Soon after we came down on Siacan Valley, which is ten miles across, and is covered with grass. The creek of that name runs into it, and is lost in a great bed of rushes. Only two houses are in it, and these are close together. The people own numerous cattle.

From this valley we saw a large pointed mountain, N. E., with a naked cone on top. I crossed the first range of hills at its foot, and then got off my horse and had my guide to mark on the ground a sketch of the remainder of the way. I was still twenty miles from Silver Lake. I then sent him back to bring on the wagon, and came on alone. I passed a valley where some horses grazed, but no one lived, and leaving it, I crossed a hill of lava rocks, where I lost the trail, as it did not show. I found it again, and soon came to a part of the mountain-side where the woods were on fire. This I soon passed, and presently came out of the forest into a great open valley, which seemed to be covered with "sage brush." There were mountains north and west, but east the horizon was like that of the sea. I had reached Silver Lake Valley, which is a branch of the Oregon Desert. Pretty soon the road forked, and I was puzzled. It is necessary to be very careful about traveling alone in a sage brush desert, for one may easily die for want of water. I rode up on a hill and took a better view of the country, but got no satisfaction. The large mountain behind me was evidently an old volcano, and its sides were covered with pumice and vesicular lava, often of a red color; and lava capped the low mountains to the north (Fig. 1.) I chose the principal road, thinking that, right or wrong, it

PLATE XL



SILVER LAKE, LOOKING SOUTH-EAST.

etc

would lead me to water. I followed it, say ten miles, and the sun was just going down when to my delight I came on the banks of a cold stream, which I afterwards found was Silver Creek. Horse and I enjoyed a good drink, and I started again. In a few miles I reached the Eugene road, and found a house. The Indian's sketch had not been correct, for I now knew where I was. I asked for pasture for the horse, but could get no satisfaction, the grass of the creek bottom being fenced in. I, however, crossed the creek, passed through a fence, and followed the creek behind a thick growth of willows. I pastured my horse in good grass, and got a nook near the water for a camp. I hunted wood and made a fire, as it was getting cold, and then I opened my provisions. I cut the can of tomatoes and broke my

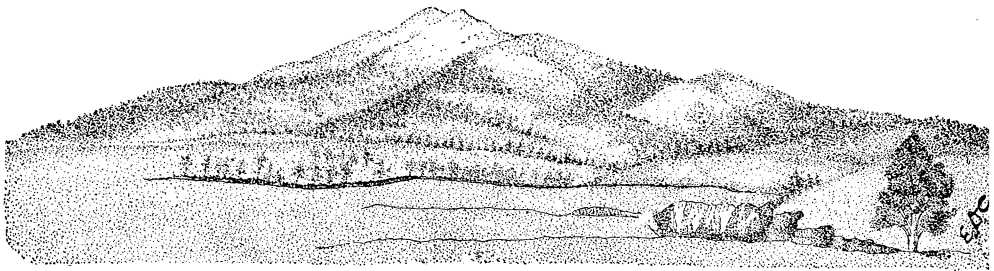


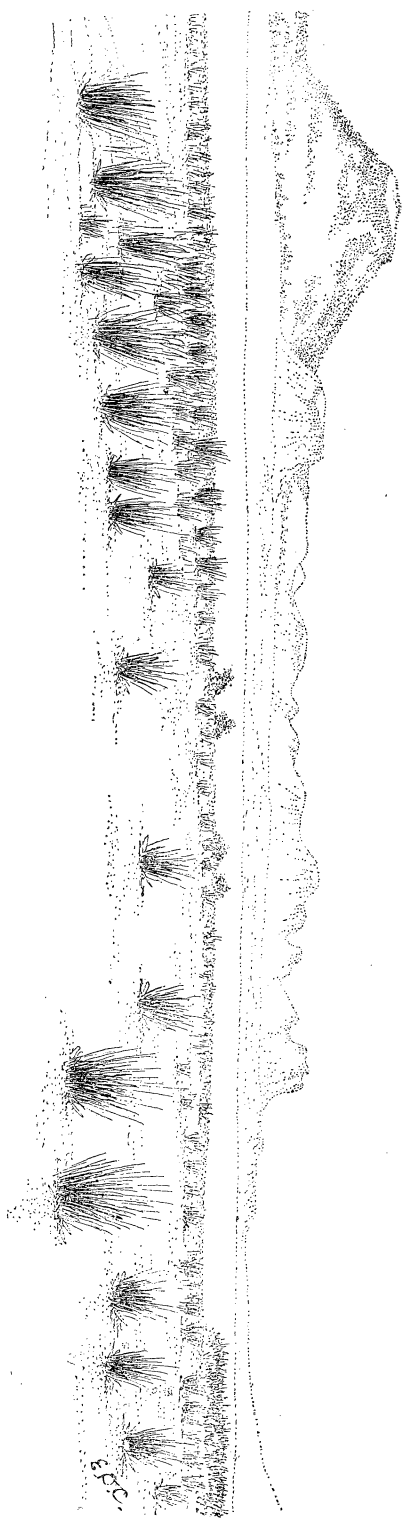
FIG. 1.—WINTER MOUNTAIN LOOKING WESTWARD.

hard biscuit in it, and set it on the coals. Then I cut some slices of bacon, and put them on top of the tomato can, which had to serve as a frying-pan. It didn't fry very fast, but finally all was ready, and with a saddle-blanket for a chair, a newspaper for a table, and a biscuit for a plate, I ate a good supper with a great appetite. I had ridden forty-five or fifty miles, and was tired. I soon got into my blankets, but didn't get to sleep as soon as I wished. A pair of small (?) owls took a position near, and cried continually. They were driven off by a pair of huge owls which screamed like a wagon-wheel without grease, horribly, and flew close over my face on a tour of inspection. However, I enjoyed a delightful sleep at last, and woke up early, ate some cold tomatoes, and got on the road. After eight miles through the

sage-brush, I reached the house of Mr. George Duncan, on the shores of Silver Lake. The next day after I arrived, the guide and one soldier came in with a note from the Corporal stating that the wagon had broken down, and they could get no farther! So I hired a man to go and bring on my stuff, and then the soldiers hired him to take their part of the load back to Fort Klamathe

Silver Lake measures about twelve miles long by eight miles wide. It is supplied with fresh water from Silver Creek which enters it from the north-west and has a swampy delta. The *Salmo purpuratus* are numerous in the creek, but they do not enter the lake, owing to the alkaline character of its waters. A smaller fresh stream enters at about the middle of the western shore. The lake is bounded on the west and east by precipitous basaltic bluffs (Plate XL.) On the south the bluffs present their dip edges to the lake, since the general strike is north and south. As I have observed in the lakes further south, i. e., Pyramid Lake, Nevada, and Warner's, Abert and Summer Lakes, Oregon, the basaltic beds dip away to the east from the bluffs which bound the east sides of the lakes, showing that the latter occupy fissures or fractures in the beds, which have a north and south direction. On the north side Silver Lake is bounded by a range of low hills, terminating in a bold flat-topped butte to the east, which is composed of volcanic mud more or less irregularly stratified (Pl. XLI.) A low shore and plain separate this range from the eastern bluffs, and at this point, overflow from the lake reaches a low tract to the eastward, which, when it contains water, is known as Thorne's Lake. It was dry at the time of my visit, (1879). On climbing the bluff which bounds the lake on the west, the observer stands on the edge of a plain which extends to the foot of the ancient volcano which I passed on the way to the lake. It is here seen to form but a single mountain with its foothills, forming a line north and south. It occupies the position of the so-called "Winter Range" of the U. S. War Department maps; but it is rather entitled to be called Winter Mountain than a "range." Its summit is bold, but had no snow on it at the time of my visit (Fig 1). Its slopes are thickly clothed with forests of pine (*Pinus ponderosa*).

PLATE XLI.



SILVER LAKE, LOOKING NORTH.

From the summit of the bluffs on the east, the eye ranges over the sage-brush desert of Central Oregon. Its surface is diversified by hills and bluffs, which have generally one slope, and one precipitous side running generally north and south. The surface was everywhere dotted with the ubiquitous sage-brush (*Artemisia*), with here and there a generally distorted cedar (*Juniperus*). This scene extended as far as the eye could reach, being bounded on the north-east by the long, low outline of the Wagon-tire mountain.

The fauna of the lake interested me, and I was curious to know the species of fishes, if any, which inhabited its alkaline waters. These proved to be all Cyprinidæ, and of but one species; viz.: *Myloleucus formosus* Girard, which I found also in Aberts Lake and Warners Lake.

The only Batrachian which I found was the tree-frog, *Hyla regilla* B. and G., which was quite common near the water's edge. I have never known this species to be taken in trees. Of reptiles the most abundant was the *Uta stansburiana* B. and G., which occurs whenever it can sun itself or find concealment on the volcanic rocks. A variety of *Sceloporus undulatus* Harl. was also common; but of other lizards I found none. The two snakes were the red spotted garter snake, *Eutania sirtalis pickeringii* B. and G., and the rattlesnake, *Crotalus confluentus lecontei* Hallow. I found one of the latter near the house, and wrapping my hand well in my pocket handkerchief, I clapped it over his head, and transferred him to a bottle of alcohol in short order.

Birds are abundant on the lake. Geese and swans were always in sight, and pelicans and cormorants were common. The grebe *Podiceps occidentalis* Lawr. was to be seen singly or in pairs on the water at all times of the day, and their musical, finely trilled note was one of the commonest sounds of the day or evening. They possess in a high degree the peculiarity of their tribe, that of immediately sinking from view, and of reappearing at a distance after a submerged swim. Of the land birds, the most noteworthy was the *Myiadestes townsendii*. It is the most beautiful songster of the far west, rivaling in this respect its con-

genera of tropical America. Its note is not so loud and varied as that of the Mexican "clarine" (*M. obscurus*), but is sweet and subdued. The favorite position of the bird is on the summit of a dead tree, whence it sallies, flycatcher-fashion, after its insect food. The *Turdus naevius* appeared in small flocks, with the manners and movements of our robin; and the mountain mocker, as I supposed it to be (*Oreoscoptes montanus*), was common in the thickets. The woodpeckers were represented by the *Melanerpes torquatus* Wilson, whose peculiar irregular flapping flight is familiar to all persons who have seen the pine woods of the Rocky Mountains.

The Mammalia to be found about the lake are those common to the region. The antelope, coyote (*Canis latrans*), badger, and skunk were easily found by sight or smell. By far the most abundant order is that of the Glires (rodents). I picked up a dead *Thomomys bulbivorus* near to Duncan's house. In the sage desert west of the house the chipmunk (*Tamias asiaticus quadrivittatus* Say), a small Spermophilus, and four species of rabbits abounded. The *Tamias* has the habit of climbing up the slender stalks of grasses and other plants for the purpose of feeding on the seeds. In such positions, when their attitudes remind one of a bird rather than of a mammal, they are easily secured. The rabbits inhabit the sage-brush in great numbers. The species are the *Lepus campestris* A. and B., *L. callotis* Wagl., *L. silvaticus* Bachm., and the *L. trowbridgii* Baird. The first-named is the largest, and is the least abundant. It is easily recognized by its light colors and its relative long tail. The jackass rabbit (*L. callotis*) is the most abundant, and is the most important as an article of food. The cotton-tail, *L. silvaticus*, has the same characters as elsewhere, and differs from the two large species in its habit of running into holes. A most curious species is the little *L. trowbridgii*, which I first detected in this region, its previously known habitat having been the coast of California. Its color is a uniform bright rufous or rusty, and it appears, when running, to have no tail at all. Its movements are most erratic, dodging suddenly from one direction to another, so that it is very difficult

to shoot. I failed completely to hit one, after many trials, and my identification was based on specimens sent me afterwards by Mr. Duncan.

After remaining for a few days at Mr. Duncan's, there arrived a guest to whom I became under great obligations. This was Mr. Charles Whittaker, the son of Governor Whittaker, of Oregon. Learning that I wished to visit and explore the remarkable deposit of fossil bones known as Fossil Lake, he placed his conveyance, drawn by two fine horses, and his time, at my disposal. Fossil Lake lies about forty miles to the eastward of Silver Lake, in the desert, and the trail through the sage-brush was passable for a wagon. Water could be had by digging, but food for the horses must be carried.

We left the lake by the low pass on the northeast, and, passing by the flat that held Thorne's Lake when it existed, drove to Christmas Lake, our first stopping-place. This is a small body of water of but few square miles in extent, and is excessively alkaline. Its waters have no appreciable effect on the arid shores, which were dry and dotted with the sage-brush almost to its edge. I found abundance of larvæ of dipterous insects, and crustaceans, as Cyclops, in the water; but a rancher who lived near by, told me that it contained no fishes, a statement which I could readily believe. Avosets (*Recurvirostra*) and stilts (*Himantopus*), waded in the shallows, feeding, I suppose, on the invertebrate life which I observed. From the rancher I obtained some beautiful obsidian arrow-heads and scrapers which he had found at Fossil Lake.

By early the next evening we had reached the "bone yard." We dug two holes in a low place, one for ourselves and one for the horses, getting clear water, somewhat alkaline to the taste, at a depth of about eighteen inches. We soon had a brisk fire of dry sage-brush; and bacon and mutton, potatoes and canned tomatoes, were soon in condition to satisfy the appetite which only the camper in the dry regions of the West experiences. We rolled up in our blankets, and my last thoughts before entering dreamland were of what I should find on the morrow.

The "bone yard" was found by cattlemen who were looking up stock which had wandered into this forbidden region, and many of the best specimens were carried off by them and lost to science. The first naturalist who visited it was Professor Thomas Condon, of the University of Oregon, at Eugene, who, with the care for scientific research which has always distinguished him, saved many good specimens and brought them home to his museum. One of these was part of the jaws of the remarkable llama, of about the size of a mule, which I called *Eschatus longirostris*. Subsequently my assistant, Mr. Charles H. Sternberg, of Lawrence, Kansas, visited the place, and made what is probably the largest collection ever made there. In this I found three species of llamas, the *Holomeniscus hesternus* Leidy, previously known from California, as large as a camel; and the *H. vitakerianus* Cope, as large as a vicugna, which I dedicated to my friend Mr. Whittaker. The third was a curious species, the size of a camel, which I also found in the collections made by MM. Castillo and Barcena in the Valley of Mexico. I called it *Eschatus conidens*. There were two species of true horses (*Equus*) both extinct; and a hugh sloth (*Myiodon sodalis*, Cope) as large as a grizzly bear. The mammoth (*Elephas primigenius* Blum.) was represented, together with numerous smaller mammals of species both recent and extinct. There were coyotes, otters, beavers, gophers (*Thomomys*), voles and rabbits, and the phalange of a bear; but no peccaries, tapirs, raccoons or opossums, which one would find in similar company in corresponding beds in the eastern states. Then there were multitudes of bones of birds and of fishes. These were all of existing genera and often species. I detected a few novelties, as a swan (*Cygnus paloregonus*); a goose, (*Anser hypsibatus*), and a cormorant, (*Phalacrocorax macropus*). One of the most abundant species was a grebe, which I could not distinguish from the one so commonly seen in Silver Lake, (*Podiceps occidentalis* Lawr.). Other species still await determination. Of the fishes, all belonged to the families of chubs and suckers, and several of them to species still living in the Silver and Klamath Lakes.

The next day I set out early to explore the ground. I found it to be a slight depression, embracing perhaps twenty acres, which was devoid of sage-brush, but was dotted with occasional plants of greasewood (*Sarcobatis vermicularis*), a fact due to the presence of water beneath the surface. The latter was, however, perfectly dry, and consisted of a light-colored mixture of sand and clay, or a dried lacustrine mud of volcanic origin. It was perfectly movable by the wind, and of indefinite depth. Fragments of bones and teeth were not rare. The most abundant were those of the large horse, *Equus occidentalis* Leidy, and the *Holomeniscus hesternus* Leidy. I found also bones and fragments of the *Elephas primigenius*, and the greater part of the skeleton of a Thomomys. I obtained, in fact, representatives of most of the species previously discovered, including numerous birds and fishes. All were on or in the loose, friable deposit. Portions of the surface were white with the shells of the *Planorbis (Carinifex) newberryi* Lea, a species which is still living in Klamath Lake. Scattered everywhere in the deposit were the obsidian implements of human manufacture. Some of these were of inferior, others of superior workmanship, and many of them were covered with a patine of no great thickness, which completely replaced the natural lustre of the surface. Other specimens were as bright as when first made. The abundance of these flints was remarkable, and suggested that they had been shot at the game, both winged and otherwise, that had in former times frequented the lake. Their general absence from the soil of the surrounding region added strength to this supposition. Of course it was impossible to prove the contemporaneity of the flints with animals with whose bones they were mingled, under the circumstances of the mobility of the stratum in which they all occurred. But had they been other than human flints, no question as to their contemporaneity would have arisen. Similar flints have been found by Mr. W. T. McGee in beds in Nevada, which he regards as of identical age with that of Silver Lake (the "Equus Bed"); but whether diagnostic vertebrate fossils are found at that locality, does not appear to be known. The probability of the association is, however, greatly increased by the discovery, by Mr. Wm. Taylor, of paleo-

lithic flints in beds of corresponding age, on the San Diego Creek, Texas. I append a list of the species so far obtained from the Equus Beds of Silver Lake.

MAMMALIA

Holomeniscus vitakerianus Cope.

“ *hesternus* Leidy.

Eschatus longirostris Cope.

“ *conidens* Cope.

Equus major Dekay.

“ *occidentalis* Leidy.

“ *excelsus* Leidy.

Elephas primigenius Blum.

Canis latrans Say.

Lutra ?piscinaria Leidy.

Castor fiber L.

Arvicola sp.

Thomomys bulbivorus Licht.

“ ; *clusius* Coues.

Mylodon sodalis Cope.

AVES.

Podiceps occidentalis Lawr.

“ *californicus* Heerm.

Podilymbus podiceps Linn.

Graculus macropus Cope.

Anser hypsibatus Cope.

“ *canadensis* L.

“ *albifrons gambeli* Hartl.

“ near *nigricans* Lawr.

Cygnus paloregonus Cope.

Fulica americana Gmel.

And numerous other species.

PISCES.

Leucus altarcus Cope.

Myloleucus gibbarcus Cope.

Cliola angustarca Cope.

Catostomus labiatus Ayres.

“ *batrachops* Cope.

One day we made an exploration of the desert in the direction of Wagontire Mountain towards the north-east. After traversing the sagebrush for two hours we reached the sandy desert of which we had heard. An apparently endless expanse of sand-dunes extended to the west, the north and the east. These dunes were not conical, but had a sloping side to the south-west, and a perpendicular face to the north-east. As the wind blew strongly from the south-west, the sand slowly crept towards the summit, and then fell in a fine shower to the base below. In this way the dunes constantly shift their position north-eastward till they reach the slopes of a range of hills, where they are banked up so as to be visible at a long distance. The sand I found to be soft and difficult for man and beast. At intervals there are shallow ravines lined with bunches of coarse grasses. Several species of finches inhabit these places, and feed on the seeds. Among these I occasionally saw the desert Pipilo, *P. chlorurus*. At one of them I found a set of Indian domestic implements; a flat dish and several pestles carved so as to have a portion for the hand separated from the head by a shoulder. All were made of the vesicular basalt, and some of them were colored red, like that found on the slopes of Winter Mountain. As no camp could well have continued there, it appeared that these implements had been left or thrown away. This sandy desert is said to be about twenty-five miles from east to west, and half as wide from north to south.

We left the sand and kept the sage-brush until about twenty-four^h miles east of our camp. Here I climbed a cliff to view the country. It was composed of the same thinly stratified volcanic mud-conglomerate as the hills that bound Silver Lake on the north. Lizards of the genera *Uta* and *Sceloporus* abounded. The scene was impressive from its wild desolation. As far as the eye could reach was the same sage-brush desert, the same waterless region of death. Many a man has entered this region never to escape from its fatal drought, especially during the first days of the overland emigration to Oregon. The Wagontire mountain, whose long and gloomy mass made the northeastern horizon, owes its name to the disastrous fate of one of those trains of

emigrants. Coming from the east, they reached the mountain with parched mouths, and eyes aching from the heat and dust, expecting to find water for themselves and animals. There is no water in this mountain, and the horses gave out in endeavoring to continue their way through its fastnesses. They lay down and died, and nothing remained of the party but a few whitened bones, and the iron tires of the wagon wheels. Many experienced hunters have been lost in this desert, and two years after my visit, one of the oldest rangers of Oregon entered it, and was never heard of afterwards. And it is indeed easy to miss the few small springs that are found at remote intervals in this desolation of one hundred and fifty miles diameter east and west and north and south.

We mounted our horses, and were glad to retrace our steps before darkness should overtake us. We kept along the southern boundary of the sand dunes as a guide, and at last struck our outward-bound trail. To reach our camp was then not difficult, and we were soon busy housekeeping round the camp-fire. After a night's refreshing sleep we returned by the way we came, to Silver Lake. Thence we took the road north to the Dalles of the Columbia, as already described in the *NATURALIST* for 1888, p. 996.